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GB 1551237 A GB 1354483 A GB 1264715 A
US 5538147 A

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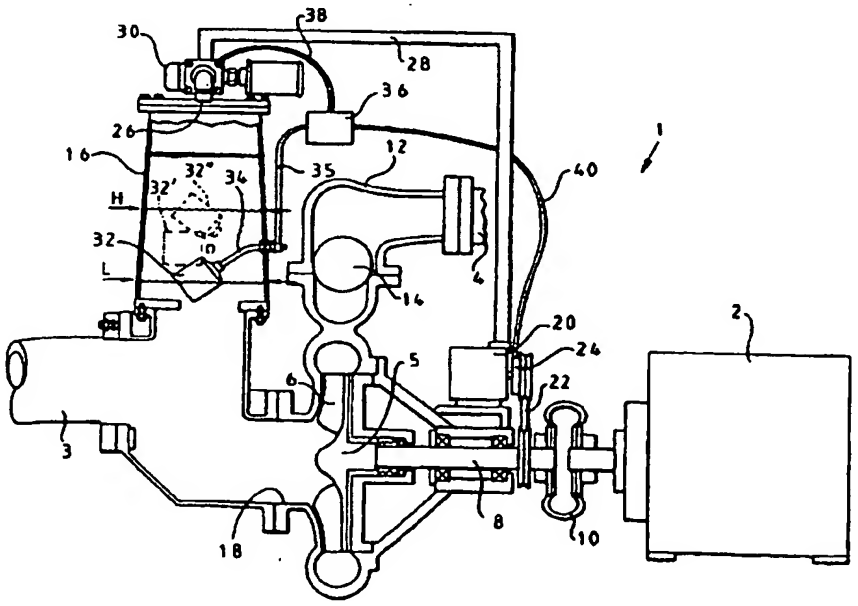
(54) Centrifugal pump priming systems

(57) A centrifugal pump priming system comprising a priming tank 16, an inlet duct 3 for the supply of water to the priming tank 16, and an exhaust passage 28 for connection to a vacuum pump 20 for applying suction to the priming tank 16 to draw water through the inlet duct 3 into the priming tank 16. A float device 32 is provided for detecting the water level in the priming tank 16 and for supplying an electrical actuating signal to a solenoid valve 30 in the event that the water in the priming tank 16 reaches a high level H to prevent further water being drawn into the priming tank 16. The solenoid valve 30 is provided in the exhaust passage 28 to cut off the suction applied to the priming tank 16 in response to the actuating signal from the float device 32. Furthermore a timer device in a control circuit 36 serves to disable the drive to the pump 20 after a predetermined interval in response to the actuating signal. Such a priming system is less subject to wear and tends to require less frequent maintenance than conventional priming systems.



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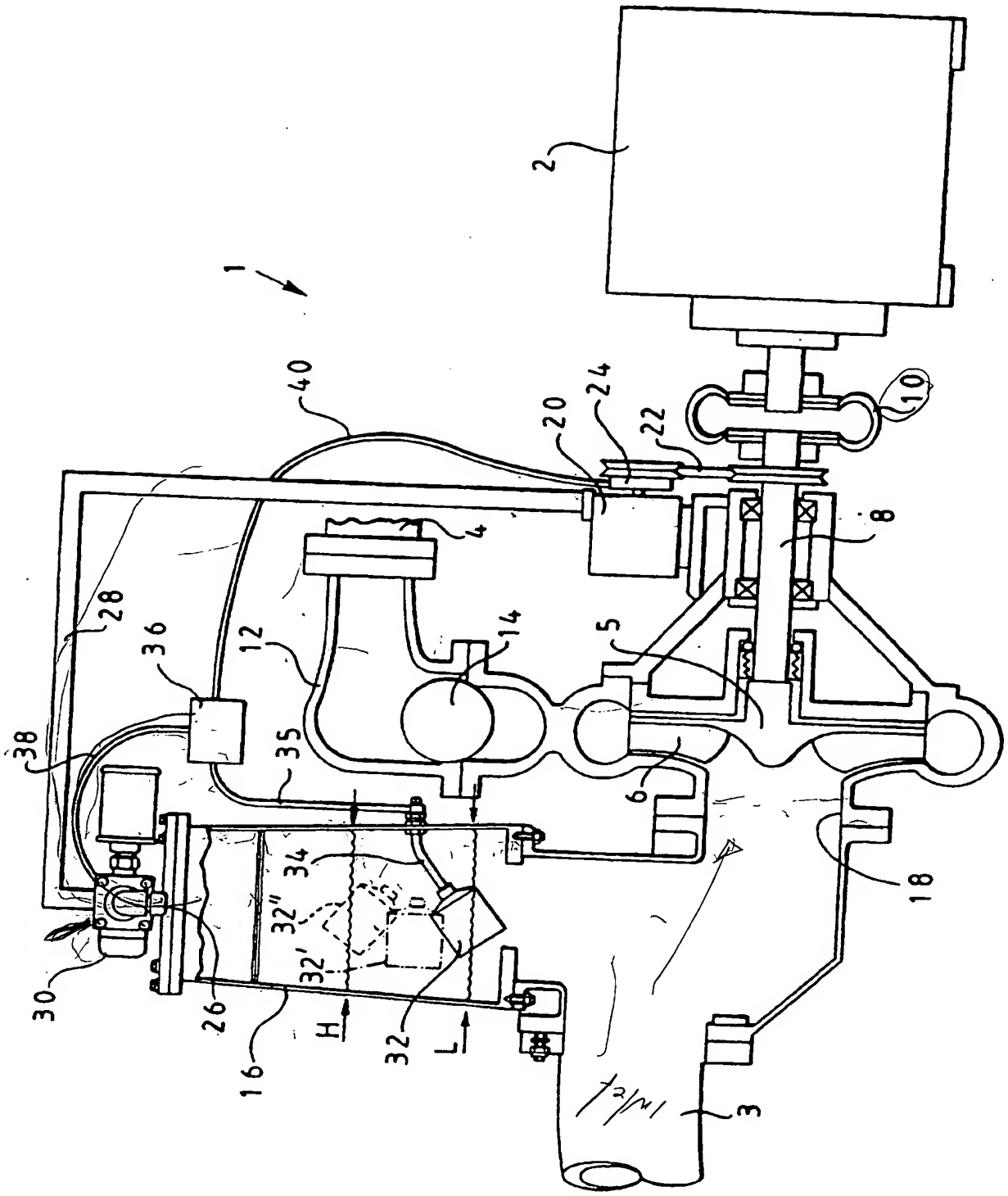
At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.



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"Centrifugal Pump Priming Systems"

This invention relates to priming systems for centrifugal pumps.

Centrifugal pumps are widely used for efficient pumping of liquids, for displacement of water from locations on a construction site, for example. However it is well known that, when such pumps are operated at a level above the free surface of the liquid to be pumped, the impeller chamber must be primed with liquid before the pump is capable of pumping liquid from a level below the impeller. British Patent Specification No. 1551237 discloses a centrifugal pump which incorporates a separate vacuum device for drawing liquid into a priming tank by suction for priming of the impeller chamber. The priming tank incorporates a float valve mechanism for preventing liquid from being drawn into the vacuum pump in the event of the liquid level in the priming tank rising above a certain level. The float operated valve mechanism includes a first valve member for closing off the exhaust passage to the vacuum device when the liquid in the priming tank reaches the certain level, and a second valve member for connecting the priming tank to atmosphere. When the liquid level in the priming tank subsequently falls, the first valve member is opened only after a time delay sufficient to enable liquid to be passed from the priming tank to the impeller chamber before suction is again applied to draw further liquid into the priming tank.

Other types of valve mechanism are known for this purpose, although all such valve mechanisms are complex mechanical devices which are subject to high

levels of wear in use and require frequent maintenance.

Furthermore such centrifugal pumps are often required to run for long periods of time unattended, and, under such conditions, the pump must be capable of running dry and of being automatically primed when the level of the liquid to be pumped again rises. Thus such pumps are arranged to run continuously so that suction pressure is available for priming of the pump at all times. However the length of time for which the vacuum device is operational for priming is only a small fraction of the time for which the pump is operational, and accordingly a large amount of energy is wasted in needlessly driving the vacuum device.

It is an object of the invention to provide an improved priming system for a centrifugal pump.

According to the present invention there is provided a centrifugal pump priming system comprising a priming tank, an inlet duct for the supply of liquid to the priming tank, an exhaust passage for connection to a suction device for applying suction to the priming tank to draw liquid through the inlet duct into the priming tank, level detection means for detecting the liquid level in the priming tank, and suction cut-off means responsive to an electrical actuating signal from the level detection means to prevent further liquid being drawn into the priming tank, the suction cut-off means including electrically operable valve means in the exhaust passage for cutting off the suction applied to the priming tank in response to the actuating signal from the level detection means.

Such a priming system is less subject to wear and tends to require less frequent maintenance than conventional priming systems.

The invention also provides a centrifugal pump priming system comprising a priming tank, an inlet duct for the supply of liquid to the priming tank, an exhaust passage for connection to a suction device for applying suction to the priming tank to draw liquid through the inlet duct into the priming tank, level detection means for detecting the liquid level in the priming tank, and suction cut-off means responsive to an actuating signal from the level detection means to prevent further liquid being drawn into the priming tank, the suction cut-off means including drive disabling means for disabling drive to the suction device.

In operation of a centrifugal pump employing such a priming system, drive to the suction device may be disabled for substantially the whole of the time that the suction device is not required to apply suction to draw liquid into the priming tank, and thus the overall energy consumption of the pump is significantly reduced. Furthermore the priming system may be produced with only a small number of moving parts so as to minimise the maintenance required whilst increasing the overall service life of the parts.

In order that the invention may be more fully understood, a preferred priming system in accordance with the invention will now be described, by way of example, with reference to the accompanying drawing, in which the single figure shows a section through a centrifugal pump employing such a priming system.

The centrifugal pump 1 shown in the drawing is of a type which is mounted on a wheeled chassis (not shown) and driven by an integral diesel engine 2, and which is capable of being towed behind a vehicle. Typically the pump 1 is towed to the site at which it is required for use, and is then operated with a suction hose 3 positioned so that its inlet end is immersed in the reservoir of water to be pumped, and so that a discharge hose 4 is positioned so as to discharge the pumped water to the intended location.

The pump 1 has a centrifugal impeller 5 disposed within an impeller chamber 6 and mounted on a drive shaft 8 arranged to be driven by the engine 2 by way of a flexible transmission coupling 10. In operation water is drawn along the suction hose 3 into the impeller chamber 6 from which it is discharged centrifugally by the impeller 5 through an outlet 12 provided with a non-return valve 14 to the discharge hose 4.

However, for the pump 1 to operate in this manner, the impeller chamber 6 must first be primed with water by drawing water along the suction hose 3 into a priming tank 16 mounted above the inlet 18 to the impeller chamber 6. To this end a rotary sliding vane vacuum pump 20 is driven through a belt transmission 22 and an electrically operated clutch 24 from the drive shaft 8, and an exhaust outlet 26 provided at the top of the priming tank 16 is coupled to the vacuum pump 20 by an exhaust passage 28 provided with a solenoid valve 30 in the vicinity of the exhaust outlet 26. When driven from the drive shaft 8 the vacuum pump 20 is capable of supplying suction to the priming tank 16 in order to draw water into the priming tank

16 along the suction hose 3.

In order to prevent water from rising in the priming tank 16 to a level at which it can be sucked into the vacuum pump 20 by way of the exhaust passage 28, a float device 32 is suspended from a wall of the priming tank 16 by a flexible arm 34 and is arranged to move up and down within the priming tank 16 in dependence on the water level so that the float device 32 adopts different orientations, as indicated by broken lines at 32' and 32", depending on the water level. The float device 32 incorporates a mercury tilt switch having a quantity of mercury within a tumbler which is capable of closing alternative sets of contacts depending on which of two orientations is adopted by the float device. Such a float device is described in US Patent Specification No. 4302641. Thus the float device 32 supplies a low level detection signal to a control circuit 36 by way of a signal line 35 when the orientation of the float device indicates that the liquid is at the low level L, and supplies a high level detection signal to the control circuit 36 when the orientation of the float device indicates that the water is at the high level H. The control circuit 36 is connected to the solenoid valve 30 and the electrically operated clutch 42 by actuating lines 38 and 40 for control of the priming process in a manner which will be described below.

On initial start up of the engine 2, the impeller chamber 6, the priming tank 16 and the suction hose 3 are empty of water, and the float device 32 is at the low level L so that a low level detection signal is supplied to the control circuit 36 indicating that no water is present in the priming tank 16. This causes the control circuit 36 to switch the clutch 24 to the drive position and to switch the solenoid

valve 30 to the open position. Furthermore the non-return valve 14 provided in the discharge outlet 12 is in the closed position under the influence of gravity. Thus the vacuum pump 20 is caused to draw air from the priming tank 16 and the suction hose 3 and hence to lower the pressure within the priming tank 16 and the suction hose 3 such that the action of atmospheric pressure acting on the surface of the water to be pumped causes the water to rise up the suction hose 3 into the priming tank 16 and the impeller chamber 6. This permits the impeller 5 rotated by the engine 2 to begin to generate pressure, and, when sufficient pressure has been generated, the non-return valve 14 is opened and water is discharged into the discharge hose 4 so that normal pumping operation of the pump is initiated.

When the water in the priming tank 16 reaches the high level H, a high level detection signal is supplied by the float device 32 to the control circuit 36, and the control circuit 36 switches the solenoid valve 30 into the closed position. At the same time a timer device in the control circuit 36 is actuated, and, after a predetermined interval determined by the timer device, drive to the vacuum pump 20 is disabled by switching the clutch 24 to the non-drive position. Thus drawing of water into the vacuum pump 20 is prevented, and drive to the vacuum pump is disabled when the application of suction pressure to the priming tank 16 is not required, thus reducing the overall energy consumption and minimising the quantity of diesel fuel required to drive the pump for an extended length of time.

If gas enters the priming tank 16 so as to cause the float device 32 to fall to the low level L, the float device 32 supplies the low level detection signal to the

control circuit 36 which again switches the clutch 24 to the drive position and the solenoid 30 to the open position, thereby enabling the vacuum pump 20 to remove the gas from the priming tank 16 and to raise the level of water in the priming tank 16 up to the high level H again. When the float device 32 reaches the high level, the control circuit 36 is again caused to repeat the sequence of operations previously described.

CLAIMS

1. A centrifugal pump priming system comprising a priming tank, an inlet duct for the supply of liquid to the priming tank, an exhaust passage for connection to a suction device for applying suction to the priming tank to draw liquid through the inlet duct into the priming tank, level detection means for detecting the liquid level in the priming tank, and suction cut-off means responsive to an electrical actuating signal from the level detection means to prevent further liquid being drawn into the priming tank, the suction cut-off means including electrically operable valve means in the exhaust passage for cutting off the suction applied to the priming tank in response to the actuating signal from the level detection means.

2. A priming system according to claim 1, wherein the suction cut-off means further includes drive disabling means for disabling drive to the suction device, and control means for actuating the valve means to cut off the suction applied to the priming tank in response to detection of a high liquid level in the priming tank by the level detection means and for subsequently actuating the drive disabling means for disabling drive to the suction device.

3. A priming system according to claim 2, wherein the control means includes timing means enabling the drive to the suction device to be disabled by the drive disabling means a predetermined length of time after cutting off by the valve means of the suction applied to the priming tank.

4, A centrifugal pump priming system comprising a priming tank, an inlet duct for the supply of liquid to the priming tank, an exhaust passage for connection to a suction device for applying suction to the priming tank to draw liquid through the inlet duct into the priming tank, level detection means for detecting the liquid level in the priming tank, and suction cut-off means responsive to an actuating signal from the level detection means to prevent further liquid being drawn into the priming tank, the suction cut-off means including drive disabling means for disabling drive to the suction device.

5. A priming system according to claim 4, wherein the drive disabling means is a clutch mechanism for coupling a drive motor to the suction device.

6. A priming system according to any preceding claim, wherein the suction cut-off means in responsive to a high level detection signal from the level detection means to prevent further liquid being drawn into the priming tank and is subsequently responsive to a low level detection signal from the level detection means to initiate drawing of further liquid into the priming tank by the suction device.

7. A priming system according to any preceding claim, wherein the level detection means comprises a float device adapted to float in the liquid within the priming tank and to provide an electrical output dependent on the liquid level.

8. A priming system according to claim 7, wherein the float device is coupled to a side wall of the priming tank by an arm permitting the float device to move up

and down with the level of liquid in the priming tank such that the orientation of the float device is dependent on the liquid level and such that a high level detection signal is outputted by the float device when the float device has a first orientation corresponding to a high liquid level and a low level detection signal is outputted by the float device when the float device has a second orientation corresponding to a low liquid level.

9. A centrifugal pump comprising an impeller, a priming tank, an inlet duct for the supply of liquid to the impeller and to the priming tank, a valved outlet duct for liquid discharged by the impeller, a suction device connected to the priming tank by an exhaust passage for applying suction to the priming tank to draw liquid through the inlet duct into the priming tank when the valved outlet is closed, level detection means for detecting the liquid level in the priming tank, and suction cut-off means responsive to an electrical actuating signal from the level detection means to prevent further liquid being drawn into the priming tank, the suction cut-off means including electrically operable valve means in the exhaust passage for cutting off the suction applied to the priming tank in response to the actuating signal from the level detection means.

10. A centrifugal pump priming system substantially as hereinbefore described with reference to the accompanying drawing.

11. A centrifugal pump substantially as hereinbefore described with reference to the accompanying drawing.

The Patent Office

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Application No: GB 9513884.8 **Examiner:** Ian Philpot
Claims searched: all **Date of search:** 30 September 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): F1C (CFKC)

Int Cl (Ed.6): F04D (9/00, 9/04)

Other: Online WPI (Questel)

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X,Y	GB 1264715 A	(ECODYNE) see page 2 lines 57-84.	4 at least
Y	GB 1551237 A	(SYKES PUMPS) see figures	
Y	GB 1354483 A	(BLAW KNOX) see figures	
X	US 5536147 A	(PACO PUMPS) see col 3 line 64 to col 4 line 10	1, 4 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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